



# Mount Rainier National Park

## Sister Mountain Project

### Cascading Effects

<b>Overview</b>	In this lesson students learn about potential impacts of climate change in Mount Rainier National Park and communicate these potential impacts to their peers through a concept web activity. This lesson will lead into <b>Enviro-Ethics</b> where students will develop a "Personal Code of Environmental Ethics "for exploring and enjoying the natural world while reducing their ecological and carbon footprint.
<b>Grade Level</b>	5-12
<b>Objectives</b>	<ul style="list-style-type: none"><li>• Students will read case studies of climate change and Intergovernmental Panel on Climate Change reports and summarize important details using words and/or labeled diagrams.</li><li>• Students will identify ways in which organisms may be affected by climate change.</li><li>• Students will explain how components of an ecosystem are interdependent.</li><li>• Students will use a variety of media to communicate their understanding to peers.</li><li>• Students will explain why understanding climate change is important.</li><li>• Students will make choices to mitigate or reduce potential negative impacts of climate change.</li></ul>
<b>Setting</b>	Classroom
<b>Time Frame</b>	Case study cards: 30 minutes Case study poster: 60 minutes Concept Web: 30 minutes Evaluation: 30 minutes
<b>Materials</b>	<ul style="list-style-type: none"><li>✓ Copies of "case study" cards for each student</li><li>✓ Poster boards</li><li>✓ Magazines</li><li>✓ Scissors</li><li>✓ Glue</li><li>✓ Markers</li><li>✓ Whiteboard</li><li>✓ Yarn</li><li>✓ Hole punch</li><li>✓ Twine or yarn</li><li>✓ 8x11" construction paper (1/student)</li><li>✓ Paper clips</li></ul>
<b>Vocabulary</b>	Adaptation, climate change, community, displacement, ecosystem, encroachment, interrelated, population

<p><b>Standards</b></p>	<p>6-8 SYSA Given a system, identify subsystems and a larger encompassing system.</p> <p>6-8 SYSC Give an example of how output of matter or energy from a system can become input for another system.</p> <p>6-8 SYSF Given a complex societal issue with strong science and technology components (e.g., overfishing, global warming), describe the issue from a systems point of view, highlighting how changes in one part of the system are likely to influence other parts of the system.</p> <p>6-8 INQC Communicate results using pictures, tables, charts, diagrams, graphic displays, and text that are clear, accurate, and informative. Recognize and interpret patterns – as well as variations from previously learned or observed patterns—in data, diagrams, symbols, and words.</p> <p>6-8 INQE Create a model or simulation to represent the behavior of objects, events, systems, or processes. Use the model to explore the relationship between two variables and point out how the model or simulation is similar to or different from the actual phenomenon.</p> <p>6-8 LS2A Give examples of ecosystems (e.g., Olympic National Forest, Puget Sound, one square foot of lawn) and describe their boundaries and contents.</p> <p>6-8 LS2B Analyze the flow of energy in a local ecosystem, and draw a labeled food web showing the relationships among all of the ecosystem’s plant and animal populations</p> <p>6-8 LS2D Predict what may happen to an ecosystem if nonliving factors change (e.g., the amount of light, range of temperatures, or availability of water or habitat), or if one or more populations are removed from or added to the ecosystem.</p> <p>6-8 LS2E Investigate a local environmental issue by defining the problem, researching possible causative factors, understanding the underlying science, and evaluating the benefits and risks of alternative solutions.</p> <p>6-8 LS3D Give an example of a plant or animal adaptation that would confer a survival and reproductive advantage during a given environmental change.</p> <p>6-8 LS3E Given an ecosystem, predict which organisms are most likely to disappear from that environment when the environment changes in specific ways.</p>
<p><b>Background</b></p>	<p>Climate change is a controversial topic that is not well understood by students—or the general public for that matter. The Intergovernmental Panel on Climate Change (IPCC) defines climate change as <i>“a change in the state of the climate that can be identified and that persists for an extended period, typically decades or longer.”</i> Whether this change is human</p>

	<p>induced or not, one thing is for sure: Mount Rainier National Park has been greatly impacted by climate change since its adoption as our 5<sup>th</sup> national park.</p> <ul style="list-style-type: none"> <li>• In the last 100 years, global average surface temperatures have risen by 0.74°C.</li> <li>• The rate of warming has doubled from the previous century.</li> <li>• 11 of the 12 warmest years dating from 1850 have occurred since 1995.</li> <li>• Land regions have warmed faster than oceans.</li> <li>• Northern latitudes have warmed faster than tropics.</li> <li>• Winter temperatures are increasing faster than summer temperatures which greatly affects whether precipitation falls as snow or rain.</li> <li>• The frost-free period in mid- to high latitude regions is increasing, leading to earlier peak runoff and warming of lakes and streams.</li> <li>• Arctic sea ice has shrunk up to 39% below the long-term average and continental snow and ice is declining.</li> <li>• More precipitation is falling as rain and less as snow.</li> <li>• Sea levels have risen an average of 3.1 mm a year from 1993-2003.</li> </ul> <p>Much of Mount Rainier lies in the western mountain and forest ecosystem. Mount Rainier holds the most extensive glacier system in the lower 48 states. These ecosystems are very sensitive to minute changes in warming due to the elevation differences that signify these biomes. Climate models predict that the average warming to be expected in the Pacific Northwest during the next 50 years is 0.1-0.6°C per decade. The last 0.74°C change has led to changes in the alpine and subalpine forest/meadow ecosystem; another 1.5°C is sure to cause exponentially more devastating impacts.</p> <p>A detailed background of the National Park Service mission and management techniques in response to climate change can be found online at:  <a href="http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=180143">http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=180143</a></p>
<p><b>Procedure</b></p>	<p><b>Pre-Activity Discussion:</b></p> <ol style="list-style-type: none"> <li>1. Ask students to think about what climate change means to them.</li> <li>2. Pass out white board markers to students and have them construct a list of ideas on a white board, overhead, etc.</li> <li>3. Ask students to predict what might happen to places such as Mount Rainier as a result of climate change.</li> <li>4. List consequences on the white board.</li> <li>5. Pass out climate change evidence flash cards to students and have them read aloud to the class the information on the flash card.</li> <li>6. Explain that they will work in four different groups and be reading and reporting on four “case studies” that describe how climate change has impacted different components of mountain ecosystems in Mount Rainier National Park.</li> </ol> <p><b>Case Study Activity:</b></p> <ol style="list-style-type: none"> <li>1. Divide students into four groups</li> <li>2. Assign each group a “case study” and provide each member of the group a copy</li> </ol>

	<p>of the “case study” card.</p> <ol style="list-style-type: none"> <li>Have students read their “case study” cards individually and discuss amongst their group.</li> <li>Student groups then construct a poster to communicate their “case study” to the rest of the class. They should focus on 4-5 points from the “case study” to share. Students can use magazines to cut out pictures that relate to their “case study.”</li> <li>Post student posters where students have access to them for the concept web activity.</li> <li>Let the class walk around the room and look and learn from each of the “case study” posters.</li> <li>Have each student write down one important interconnection from one of the “case study” posters on a piece of 8X11” construction paper (for example: less snowfall in the winter could cause less water for mountain streams which salmon need to spawn). Using a piece of yarn make a necklace out of the interconnection card to be worn for the living web activity.</li> </ol> <p><b>Procedure:</b></p> <ol style="list-style-type: none"> <li>Begin by constructing a living concept web using a ball of string and the entire class.</li> <li>Have students wear their interconnection card necklace so that it is visible to the rest of the class.</li> <li>Have the class form a one big circle standing shoulder to shoulder.</li> <li>Randomly pick one place to start and hand that student the ball of string. Have that student decide another concept that is related to their concept and toss that person the ball of string while still holding on to the end. Have that student describe why they made that choice and defend with specific details.</li> <li>Have students continue tossing the string around the circle until everyone has received the string at least once.</li> <li>Once finished, the students place the string on the ground and a web will be formed. Have the students attach their labels in their proper positions around the web using a paper clip.</li> <li>Students can observe the interconnectedness of the components of the web by selecting one student to pull on their string and observe what other components are impacted as a result.</li> </ol> <p><b>Post Activity Discussion Questions:</b></p> <ul style="list-style-type: none"> <li>How are the components of mountain ecosystems interrelated?</li> <li>What adaptations would improve each of these organisms’ ability to survive?</li> <li>Which species are most likely to go extinct? Explain.</li> <li>Why is understanding climate change important?</li> <li>What can you do to mitigate or reduce your negative contributions to climate change?</li> </ul>
<b>Suggested Assessment</b>	<ul style="list-style-type: none"> <li>Asses student “case study” poster board presentations</li> <li>Provide the class with pictures of different components of an ecosystem and have</li> </ul>

	<p>them predict how climate change could potentially impact that component.</p> <ul style="list-style-type: none"> <li>Have students write a reflective paragraph about the “case study” concept web using the 1-2-3 paragraph approach: <ol style="list-style-type: none"> <li>1. Give 1 reason why understanding climate change is important.</li> <li>2. Share 2 things that you learned that you didn’t know before.</li> <li>3. Provide 3 things you can do at home to reduce your carbon footprint.</li> </ol> </li> </ul>
<b>Adaptations</b>	<p>Instead of creating “case study” poster boards, have students create a movie about the “case study” topics using an on-line program such as Animoto: <a href="http://animoto.com/">http://animoto.com/</a>. Plan a climate change film festival where groups can present their findings from the “case studies”.</p>
<b>Extensions</b>	<p>Students can calculate their carbon and ecological footprints using one of the online carbon calculators such as the one available at <a href="http://www.nps.gov/climatefriendlyparks/">http://www.nps.gov/climatefriendlyparks/</a>  <a href="http://www.carbonfootprint.com/calculator.aspx">http://www.carbonfootprint.com/calculator.aspx</a>  <a href="http://www.zerofootprintkids.com/kids_home.aspx">http://www.zerofootprintkids.com/kids_home.aspx</a></p> <p>Students can visualize some of the effects of climate change on the Pacific Northwest by watching the TERRA video “Cascading Effects” found online at <a href="http://www.lifeonterra.com/episode.php?id=178">http://www.lifeonterra.com/episode.php?id=178</a></p> <p>Students can read about climate change observations from around the world on the “WWF – Climate Witness in Action” website  <a href="http://www.panda.org/about_our_earth/aboutcc/problems/people_at_risk/personal_stories/">http://www.panda.org/about_our_earth/aboutcc/problems/people_at_risk/personal_stories/</a></p> <p>Students can write their own Climate Witness story and submit it to  <a href="http://www.panda.org/about_our_earth/aboutcc/problems/people_at_risk/personal_stories/">http://www.panda.org/about_our_earth/aboutcc/problems/people_at_risk/personal_stories/</a></p> <p>Students can plan a climate related service project for their school (see activity for <i>Improve Your Place</i>) such as a recycling program, public service announcement, “reducing your carbon footprint tip of the week,” etc.</p>
<b>References/ Resources</b>	<p>Andre, E. K. “Communities of living things.” Will Steger Foundation. Available online at <a href="http://www.worldwildlife.org/climate/curriculum/WWFBinaryitem5963.pdf">http://www.worldwildlife.org/climate/curriculum/WWFBinaryitem5963.pdf</a></p> <p>Bullock, A. (2007). Revised Mummart, J (2008), Revised King, R. and Walkinshaw, E. (2009). “The flood of 2006 report.” Mount Rainier National Park. Available online at <a href="http://www.nps.gov/mora/parkmgmt/upload/2006%20Flood%20Report%20Final%20Web.pdf">http://www.nps.gov/mora/parkmgmt/upload/2006%20Flood%20Report%20Final%20Web.pdf</a></p> <p>Climate Change Science Program (CCSP). (2008). “Preliminary Review of Adaption Options for Climate-Sensitive Ecosystems and Resources (SAP 4.4)”. U.S. Environmental Protection Agency, Washington, D.C. Available on line at <a href="http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=180143">http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=180143</a></p>

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